- Origamizer folding exercise

Tips:
- Rhino’s Face3D + Join + Weld (180) FTW
- export OBJ as Polygon Mesh
- turn on Angle Condition

- Convex vs. nonconvex vertices

\[ 3 \cdot 60^\circ = 180^\circ \]
\[ 6 \cdot 90^\circ = 540^\circ \]
\[ \sum \Theta_i \leq 360^\circ \]
\[ \sum \Theta_i > 360^\circ \]

- DEMO of \( \Delta \) in Origamizer

- Freeform Origami DEMO
• Geometric constraints:
  - Rigid Origami Simulator
    (parameterized by fold angle)
    - closure around a vertex
  - Freeform Origami
    (parameterized by 3D vertex coordinates)
    - developability
    - flat foldability
  - Origamizer
    - w/ variable setup
    - closure around a vertex
    - convexity of paper boundary
    - convexity of edge-tucking molecule
    - tuck angle condition
    - tuck depth condition

• Solve these nonlinear constraints
  via sequence of linear systems ∇
  to reduce error
  1. Euler step to make infinitesimal motion
     satisfy constraints
  2. Newton step to correct 2nd order error
NP-completeness: what, me worry?
  - local foldability seems to be enough for small rigid motions
    - OPEN: theorem?
    - amount of valid motion varies

Automatic folding:
  - simple folding robot [Balkcom & Mason 2008]
  - Printed Circuit MicroElectricalMechanical System (PC-MEMS)
    [Harvard Microrobotics Lab 2011]

Open problems in rigid origami?
  - OPEN: complexity of deciding rigid foldability of a crease pattern?
    - degree-4 vertices ⇒ easy
      [Demaine & Tachi 2012]
  - OPEN: design rigidly foldable origami (any interesting class)
  - paper shopping bags
  - OPEN: unfold from flat state with extra creases

PROJECT: port Tachi’s software to MacOS

Multiple origami from subsets of 1 CP?
  ⇒ LECTURE 7!